

1 increase the cost estimates from their previous unrealistic levels, e.g., cost of capital and  
2 depreciation lives are higher than in the previous release and the number of distribution cables  
3 in higher density areas has been increased. Despite what appear to be substantial changes,  
4 some of which should substantially change the costs of unbundled network elements, the  
5 quantitative cost results from it are actually somewhat smaller than those produced by HCM  
6 2.2.1.<sup>6</sup>

7 Of course, because it is being constantly revised and may yet change, any comprehensive  
8 evaluation of the Model can only be tentative and predicated upon the information currently  
9 available. It seems plain, however, from the TELRIC "results" for SWBT-MO's network  
10 elements submitted by AT&T in this proceeding that the basic deficiencies of the prior  
11 version(s)<sup>7</sup> continue to exist. In particular, it seems clear that the remaining flaws in HCM  
12 2.2.2 continue to bias the TELRIC estimates downward.

13 Q. WHAT ASPECTS OF HCM 2.2.2 DO YOU EVALUATE IN THIS TESTIMONY?

14 A. My testimony evaluates the following aspects of HCM 2.2.2: (1) "scorched node" framework  
15 used by the Model and its predecessors, (2) assumption that entrant will serve the incumbent  
16 LEC's *total* demand, (3) treatment of loop and switching costs, (4) assumptions about fill  
17 factors, and (5) treatment of annualized investment and operating expenses (including issues of  
18 depreciation rates and cost of capital).

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<sup>6</sup> Obviously, there are offsetting cost decreases. For example, HCM 2.2.2 assigns only one-third of loop structure costs to telephone service, under the default assumption that these costs are shared with two other providers (e.g., an electric utility and a cable television company). This sharing assumption is only partially correct for SWB - MO and, very likely, causes loop costs to be understated. Mr. Hearst has testified that while the cost of poles is shared with electric utilities, no such sharing occurs with cable television companies. Also, there is very limited sharing of the cost of trenches and no sharing of the cost of conduits. Rebuttal Testimony of James A. Hearst in this proceeding, at 2.

<sup>7</sup> See, e.g., Timothy J. Tardiff, *Economic Evaluation of Version 2.2 of the Hatfield model*, prepared for GTE, July 9, 1996, and Comments of William E. Taylor and Aniruddha Banerjee, Before the Federal Communications Commission, CC Docket No. 96-45, August 9, 1996.

1           **A. The Hatfield Model's Scorched Node Framework**

2       Q. PLEASE EXPLAIN WHY THE HATFIELD MODEL'S SCORCHED NODE APPROACH  
3       LEADS TO FLAWED COST ESTIMATES.

4       A. The scorched node assumption is not itself problematic, only the manner in which the Hatfield  
5       model interprets and implements it is. The Hatfield model's view of scorched node is that *only*  
6       the existing locations of central offices are fixed, leaving the rest of the network (outside plant  
7       like feeder and distribution facilities, switches, etc.) available for instant redesign and re-  
8       optimization. Since a substantial portion of a LEC's investments and expenses arises from  
9       outside plant facilities, this approach departs significantly from the view of the forward-  
10      looking efficient network taken by the California principles.<sup>8</sup> In addition, by positing an  
11      "instantaneous" network, the Hatfield version of scorched node ignores the impact of changes  
12      in demand on cost.

13           The Hatfield model's flawed view of the scorched node framework causes it to depart from  
14      the FCC's objective for TELRIC studies, which is to base them on a LEC's existing  
15      infrastructure. According to the FCC:

16           This benchmark of forward-looking cost and existing network design most closely  
17      represents the incremental costs that incumbents *actually* expect to incur in making  
18      network elements available to new entrants.<sup>9</sup>

19           **B. The Hatfield Model's Instantaneous Demand Replacement Assumption**

20      Q. WHAT DOES THE HATFIELD MODEL ASSUME ABOUT THE DEMAND THAT A  
21      NEW ENTRANT WILL FACE?

22      A. The Hatfield model essentially assumes that a LEC's entire demand for telephone services is  
23      constantly up for grabs. In effect, it assumes that the incumbent LEC would hand over its

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<sup>8</sup> See note 2, *supra*.

<sup>9</sup> Federal Communications Commission, *Implementation of the Local Competition Provisions in the Telecommunications Act of 1996*, First Report and Order, CC Docket 96-98, released August 8, 1996, ¶685. (Emphasis added)

1 entire business to the new entrant which, in turn, would instantly size its plant to perfectly  
2 accommodate this demand, while taking advantage of all the economies that come with  
3 serving that demand with perfectly-sized facilities obtained at the maximum possible volume  
4 discounts. It would be nice if the world worked this way because we would all like to pay less  
5 for what we consume. Unfortunately, it does not.

6 Q. WHY IS THIS ASSUMPTION PROBLEMATIC?

7 A. This assumption is problematic for two reasons. First, a real firm grows to meet demand as it  
8 materializes. As such, it adds capacity by taking into account the trade-off between the lower  
9 per-unit costs of bigger modules (e.g., larger cable sizes) and the costs of carrying the unused  
10 capacity that deploying larger modules would entail. I expand on this issue below.

11 Second, the Model assumes that the new entrant would be able to instantly and *fully* serve  
12 all volumes presently served by the incumbent LEC and, therefore, to realize the fullest extent  
13 of the economies of scale and scope presently experienced by the incumbent. In a competitive  
14 market, no single firm (incumbent or entrant) is likely to serve the volume currently being  
15 served by the incumbent LEC.<sup>10</sup> Accordingly, there is a strong possibility that, as it surrenders  
16 some portion of its market share to entrants, the incumbent LEC's own incremental costs are  
17 likely to *rise* because any reduction of the volume served by it may cause it to suffer a  
18 reduction of its scale economies as well. In other words, the incremental costs experienced  
19 when multiple firms share the existing market demand are likely to be *higher* than those under  
20 pure monopoly supply. By missing this possibility, the Model will likely understate costs.

## 21 C. Treatment of Network Components in the Hatfield Model

### 22 1. Loops

23 Q. HOW DOES THE HATFIELD MODEL DEVELOP COSTS FOR OUTSIDE LOOP PLANT?

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<sup>10</sup> Of course, if the prices of unbundled network elements are set too low, efficient entry and competition could well fail to develop, thus undermining the purpose of the Telecommunications Act of 1996. In this event, use of the results of HCM 2.2.2 would serve to "verify" the assumption of total volume being served by a single provider, albeit at the expense of effective competition and to the detriment of consumers.

A. For the most part, the Hatfield model's development of loop costs relies on a revision to the Benchmark Cost Model (BCM Plus). The original model (BCM) was filed with the FCC by MCI, NYNEX, Sprint, and US West. BCM identified geographic areas where costs of basic residential access service are relatively high or low cost. The sponsors described their model as follows.

The BCM does *not* define the *actual* cost of any telephone company, nor the embedded cost that a company might experience in providing telephone service today. Rather the BCM provides a benchmark measurement of the relative costs of serving customers residing in given areas, i.e., the CBGs [Census Block Groups].<sup>11</sup>

What is noteworthy about this description of purpose is that the costs that the BCM produces are not the actual costs of any particular company. Despite this acknowledgment by the BCM's sponsors, the proponents of the Hatfield model incorrectly propose to use parts of the BCM, albeit revised, to produce actual prices for the incumbent LEC's unbundled elements.

Q. WHAT PROBLEM IN THE BCM IS TRANSFERRED TO THE HATFIELD MODEL?

A. The BCM starts with the current locations of the LEC's central offices.<sup>12</sup> The model constructs loop plant (feeder, distribution, and associated structures) from the central office locations to the households in the CBG by means of specific engineering rules, e.g., the lines served by a particular central office are the result of assigning CBGs to the closest wirecenters.

This assignment does not necessarily assign the households within the CBG to the wire center that actually serves them. For example, in California, Pacific Bell and GTE have found that the BCM assigns substantial percentages of households to the wrong wirecenter. As a result, the network represented by the BCM departs from the LEC's actual network. The Hatfield model's proponents may argue that the BCM has assigned households more efficiently than the LECs have. A more likely explanation is that the extremely abstract

<sup>11</sup> MCI Telecommunications Corporation, NYNEX Corporation, Sprint Corporation, and US West Inc., "Benchmark Cost Model," submitted to the FCC, CC Docket No. 80-286, September 12, 1995, at 3. (Emphasis added)

<sup>12</sup> The Hatfield model, in fact, borrows this partial view of scorched node from the BCM. The BCM does *not* regard the outside plant locations as fixed.

1 representation of the network—a featureless plain<sup>13</sup>—ignores real world constraints, such as  
2 physical barriers, e.g., rivers, lakes, and hills, between a CBG and its closest central office.

3 Mr. Flappan appears, in a convoluted way, to admit as much when he states:<sup>14</sup>

4 Neither the Hatfield Model nor any of the other cost models submitted to the PSC  
5 are planning and engineering models designed to produce specific network  
6 “schematics.” Such detailed design capabilities, even if feasible, provide little or  
7 no aid to the PSC in carrying out its responsibilities to set prices for unbundled  
8 network elements. Claims that the Hatfield model design approach would not  
9 “look” or “feel” like a “real” network, because it does not account, for example, for  
10 the actual locations of rivers, highways and buildings, are misplaced.

11 Apart from its defensive nature, I find Mr. Flappan’s assertion to be a telling commentary on  
12 the Hatfield model’s apparent unconcern with the FCC’s directive (see note 9, *supra*) that  
13 prices be based on incremental costs that LECs actually expect to incur in making unbundled  
14 network elements available. I can think of no more informed approach for the PSC to adopt  
15 for setting prices for SWBT-MO’s unbundled elements than one which takes account of the  
16 influence of Missouri’s topographical features on the actual design of even the most efficient  
17 and forward-looking of networks.<sup>15</sup>

18 Q. WHAT ARE THE CONSEQUENCES FOR LOOP INVESTMENTS OF THE HATFIELD  
19 MODEL’S IMPLICIT ASSUMPTION THAT THE ENTIRE NETWORK, GIVEN  
20 CURRENT CENTRAL OFFICE LOCATIONS, CAN BE RECONSTRUCTED  
21 INSTANTANEOUSLY?

22 A. Because it assumes that loop facilities are installed instantaneously, the BCM (hence, the  
23 Hatfield model) selects the largest available cable sizes to serve a given static volume. In  
24 contrast, because real networks evolve as demand grows and changes, firms face a trade-off  
25 between deploying larger cable sizes (and enjoying the economies of scale that result at or near

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<sup>13</sup> The only distinguishing characteristics are a number of topographical factors used to estimate the cost of installation and support structures.

<sup>14</sup> Direct Testimony of Robert P. Flappan, at 25.

<sup>15</sup> Even under a scorched node framework that allows reconstruction of the outside loop facilities, I believe the Hatfield model should be required to faithfully reproduce the efficient network that comports with Missouri’s actual topography.

1 full capacity) versus using smaller sizes, thus reducing the carrying costs of the extra inventory  
2 that large cable sizes entail. In this regard, the BCM—and the Hatfield model— may  
3 underestimate loop cost, because it could assign larger/less costly facilities (on a per-unit  
4 basis) than an efficient firm would deploy. Such “savings” are illusory, not real. What have  
5 been left out of the BCM—and the Hatfield model—are the carrying charges on the unused  
6 capacity that the larger cable sizes would require for several years, until actual demand  
7 materializes.

8 The irony of the Hatfield model’s approach here is that it will almost necessarily commit  
9 the efficient and forward-looking network (that cannot serve all of the market demand at once)  
10 to having to carry spare capacity—a source of real economic cost. Yet, Mr. Flappan<sup>16</sup> would  
11 choose to explain any network over-building as an inefficiency or a strategic move by LECs to  
12 accommodate future potential demand for enhanced and broadband services (whether or not  
13 the over-built portions of the network can, in fact, provide those services).

14 Q. DOES THE HATFIELD MODEL CORRECTLY ESTIMATE A LEC’S COST OF  
15 SUPPORT STRUCTURE INVESTMENTS?

16 A. HCM 2.2.2’s BCM Plus module estimates the cost of structures separately; however, it may  
17 still not be using the correct input prices. For at least one such structure—manholes—the  
18 default price of \$3,000 assumed in the Model is considerably lower than the \$10,000 that  
19 SWBT-MO actually pays.<sup>17</sup> This type of inaccuracy is of more than academic interest;  
20 installation and structures can account for upwards of 80 per cent of loop costs. In fact, a  
21 reasonable sanity check on the structure cost inputs would be to ascertain whether the share of  
22 loop costs accounted for by structures reasonably approximates real world experience.

## 23 2. Switching

24 Q. HOW DOES THE HATFIELD MODEL COMPUTE THE COST OF LOCAL SWITCHING?

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<sup>16</sup> Direct Testimony of Robert P. Flappan, at 31.

<sup>17</sup> Direct Testimony of Robert P. Flappan, Appendix C-6; Rebuttal Testimony of James A. Hearst in this proceeding.

1 A. HCM 2.2.2 systematically understates the cost of local switching. By selectively using heavily  
2 discounted prices for new switches and by assuming that a local service provider would  
3 instantly install all of the switching capacity it needs, the HCM 2.2.2 produces costs that are  
4 substantially lower than the forward-looking local switching costs that real telephone providers  
5 actually incur.

6 Q. WHY DOES THE HATFIELD MODEL PRODUCE DOWNWARD-BIASED SWITCHING  
7 COSTS?

8 A. The Hatfield model develops a relationship between switching cost per line and the size of the  
9 switch by piecing together information from various sources. In particular, the algorithm is  
10 driven by three data points constructed as follows.

- 11 1. Small switch: the cost per line (\$241 for 1994) is taken from the Northern Business  
12 Information report on the average cost of *new* lines for independent companies. The  
13 Model associates the average *installed* switch size of 2,782 lines with small LECs (i.e., the  
14 LEC industry less Regional Bell Operating Companies (RBOCs) and major independents),  
15 calculated from statistics on lines and switches reported to the FCC for 1993.
- 16 2. Medium switch: the cost per line (\$104 for 1994) is taken from the Northern Business  
17 Information report on the average cost of *new* lines for RBOCs. The Model associates the  
18 average *installed* switch size of 11,200 lines with RBOCs, calculated from statistics on  
19 lines and switches reported to the FCC for 1993.
- 20 3. Large switch: cost per line of \$75 for a 80,000 line switch, "obtained from switch  
21 manufacturers."

22 The Hatfield model then draws straight lines between the three points to determine a  
23 relationship between switch price and switch size. In reality, SWBT-MO's *actual* costs per  
24 line are \$268, \$231, and \$183 for small, medium, and large switches, respectively.<sup>18</sup>

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<sup>18</sup> Direct Testimony of Hugh W. Raley in this proceeding, at 8.

1       The Hatfield model's approach suffers from two problems. First, there is a mismatch  
2       between the data sources it employs. Note, for example, it matches a 1994 forecasted price  
3       with a 1993 average embedded switch size. In addition, while the Model uses independents  
4       (excluding GTE) for the small switch price, GTE is included in the calculation of the switch  
5       size. Finally, the approach assumes that the average *installed* switch is of the same size as the  
6       average *new* switch, an assumption that is not necessarily valid.

7       Second, and more fundamentally, the Hatfield model ignores the fact that LECs buy  
8       additional lines for installed switches as well as new lines for new switches. These additional  
9       lines cost more, as the study that the Hatfield model used for its switch prices describes. The  
10      add-on market continues to retain revenue potential for the suppliers, particularly as the  
11      margins on new switches remain below the margins for the add-on market. A digital line  
12      shipped and in place will generate hundreds of dollars in add-on software and hardware  
13      revenue during the life of the switch. Suppliers can afford to lose a few dollars on the initial  
14      line sale in exchange for the increased revenue in the aftermarket, when prices are less likely to  
15      be set by competitive bidding.<sup>19</sup>

16      The local switching component of the Hatfield model graphically illustrates the fallacy of  
17      its scorched node view of cost studies. In order for the approach to produce realistic costs  
18      (ignoring the data problems identified earlier), a new entrant would have to serve customers  
19      with initial lines only and also have the volumes to command the discounts that existing LECs  
20      apparently command. The fact that LECs expand their switches as demand grows and a  
21      lucrative aftermarket exists for this expansion demonstrates that the "instant LECs" posited by  
22      the Hatfield model are inconsistent with reality.

#### 23       **D. Unrealistic Fill Factors in the Hatfield Model**

24      Q. WHAT IS A "FILL FACTOR?"

25      A. Because telephone capacity is modular, i.e., it comes in sizes greater than a single unit, there is  
26      usually more capacity in place than volumes in service. Capacity exceeds volume even when

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<sup>19</sup> Northern Business Information, *US Central Office Equipment Market—1994*, McGraw-Hill, at 71.

1 the most efficient engineering practices are followed. The ratio of volume in service to  
2 capacity is the fill factor.<sup>20</sup> The spare capacity represented by a fill factor less than 100 per  
3 cent is a *current* economic cost of providing service.

4 Q. WHAT DOES THE HATFIELD MODEL ASSUME ABOUT FILL FACTORS FOR LOOP  
5 PLANT?

6 A. The Hatfield model's assumptions about fill factors for feeder and distribution loop facilities  
7 start with those in the BCM. In a previous evaluation of the BCM, Pacific Bell's cost experts  
8 compared that model's fill factors with the actual fill factors that would result from best  
9 engineering practices.<sup>21</sup> In general, the fill factors for feeder plant in the BCM were  
10 *moderately* higher than those under "best practice" conditions and the fill factors for  
11 distribution plant in high density areas were *substantially* higher than under best practice  
12 conditions. Actual distribution fill factors are relatively low because of the high cost of adding  
13 capacity after the support structure has been built. Accordingly, capacity for an indefinitely  
14 long planning horizon is installed initially and utilization of that capacity remains low for a  
15 while.

16 Unfortunately, HCM 2.2.2 has further increased the already high distribution fill factors in  
17 the original BCM, as shown in the table below. This would cause the loop costs to be  
18 understated even more.

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<sup>20</sup> A theoretical discussion of these issues appears in Richard D. Emmerson, "Theoretical Foundation of Network Costs," in W. Pollard, editor, *Marginal Cost Techniques for Telephone Services*, National Regulatory Research Institute, 1991, pp. 145-189.

<sup>21</sup> Timothy J. Tardiff, "Evaluation of the Benchmark Cost Model," prepared on behalf of Pacific Bell, for filing with the California Public Utilities Commission, Rulemaking/Investigation on the Commission's Own Motion into Universal Service and to Comply with Mandates of Assembly Bill 3643, R.95-01-020/1.95-01-021, December 1, 1995.

1

BCM

HCM 2.2.2

Density Zone	Feeder	Distribution	Feeder	Distribution
1	0.65	0.25	0.65	0.50
2	0.75	0.35	0.75	0.55
3	0.80	0.45	0.80	0.60
4	0.80	0.55	0.80	0.65
5	0.80	0.65	0.80	0.70
6	0.80	0.75	0.80	0.75

2

3           The Hatfield model's use of unrealistically high fill factors causes costs to be understated  
4 because the fill factor, in part, determines how much cable is needed. The Hatfield model  
5 appears to be based on the belief that competitive firms would have minimal spare capacity.

6 Q. BUT, WHAT ABOUT MR. FLAPPAN'S EXPLANATION [AT 31] THAT THE  
7 *EFFECTIVE* OR REALIZED FILL RATES CALCULATED BY THE HATFIELD MODEL  
8 ARE, IN MANY CASES, SIGNIFICANTLY LOWER THAN THE *INPUT* VALUES?

9 A. Mr. Flappan explains that realized fill factors would be lower than the input values because the  
10 Model's cable sizing algorithm always assigns the next largest cable size. He provides an  
11 example in which if a CBG had 70 lines and the *input* fill rate was 50 per cent, the Model  
12 would assume the need for a 140-pair cable. Because of modularity of cable sizes, the Model  
13 would automatically assign the next available cable size, namely, 200 pairs, and, as a result,  
14 produce a *realized* fill rate of  $70/200 = 35$  per cent.

15           Even with this explanation, though, there is reason to believe that the Hatfield model's  
16 realized fill rate may not be that far below the input value.<sup>22</sup> For example, if the modularity of

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<sup>22</sup> The Hatfield model documentation and output contain no information on the actual fills produced by the model.

1 cable size is not as assumed by the Hatfield model (i.e., successive cable sizes are actually  
2 closer to each other than assumed), the realized fill rate in Mr. Flappan's example will be  
3 closer to the input value. Second, in Missouri, the average realized fill rate for loop  
4 distribution produced by the Model can be shown to be 50.7 per cent, which is well above  
5 SWBT-MO's actual fill rate of 33.9 per cent.<sup>23</sup> It is worth remembering that the FCC has  
6 ordered that a "reasonable projection" of the actual fill, not some *objective* fill, be used.<sup>24</sup>

7 Q. ARE COMPETING LECS LIKELY TO HAVE MINIMAL SPARE CAPACITY, AS THE  
8 HATFIELD MODEL APPEARS TO ASSUME?

9 A. No. The FCC's finding on spare capacity in interstate long-distance, which was one of the  
10 bases for granting AT&T non-dominant status, contradicts this apparent belief:

11 AT&T asserts, and no one disputes, that MCI and Sprint alone can absorb overnight  
12 as much as fifteen percent of AT&T's total 1993 switched demand at no  
13 incremental capacity cost; that within 90 days MCI, Sprint, LDDS/Wiltel, using  
14 their existing equipment, could absorb almost one-third of AT&T's total switched  
15 capacity; or that within twelve months, AT&T's largest competitors could absorb  
16 almost two thirds of total switched traffic for a combined investment of \$660  
17 million. Thus, AT&T's competitors possess the ability to accommodate a  
18 substantial number of new customers on their networks with little or no investment  
19 immediately, and relatively modest investment in the short term. We therefore  
20 conclude that AT&T's competitors have sufficient excess capacity available to  
21 constrain AT&T's pricing behavior.<sup>25</sup>

22 To cast the FCC's findings in terms relevant to the current discussion, note that MCI and  
23 Sprint combined are roughly one-half of AT&T's size. Overnight they can absorb 15 percent  
24 of AT&T's capacity. This implies that MCI and Sprint have at least 30 per cent spare capacity  
25 that could be deployed overnight.

26 The implication of these findings is that, if anything, competition may require more, rather  
27 than less, spare capacity to allow a LEC enough flexibility to respond to the vicissitudes of the

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<sup>23</sup> This comparison is based on intermediate data produced by running the HCM 2.2.2 itself for Missouri and data provided by SWBT-MO sources.

<sup>24</sup> FCC Order. See Section 51.511 of Appendix B (Final Rules).

<sup>25</sup> Federal Communication Commission, In the Matter of Motion of AT&T Corp. to be Reclassified as a Non-Dominant Carrier, FCC 95-427, October 15, 1995, ¶59.

1 market. Failure to recover in current revenues the current cost of business (caused by the spare  
2 capacity necessary to operate in the competitive environment) would be detrimental to the  
3 shareholders of such companies, perhaps even forcing some of those companies out of  
4 business.

5 **E. Treatment of Annualized Investment and Operating Costs in the Hatfield**  
6 **Model**

7 Q. HOW DOES THE HATFIELD MODEL TREAT OR CALCULATE EXPENSES?

8 A. The various manifestations of the Hatfield model are essentially models of the *investment*  
9 component of a LEC's cost structure. These investments are converted into annual and  
10 monthly amounts by (1) annualizing the investments through the use of cost-of-capital and  
11 depreciation rates and (2) estimating out-of-pocket operating expenses through the use of  
12 historical expense-to-investment ratios.

13 Q. PLEASE ASSESS THE HATFIELD MODEL'S CHOICE OF THE COST OF CAPITAL.

14 A. The 10.01 per cent cost of capital in HCM 2.2.2, although higher than that used in earlier  
15 versions of the Model, is too low for two reasons. First, the FCC's approved rate of return  
16 remains at 11.25 percent. Second, the whole premise behind the Model's cost estimates is that  
17 they emulate the effects of competition. One of these effects is to raise the riskiness, and  
18 therefore the cost of capital, of competing firms (incumbents as well as entrants). This, in turn,  
19 should increase the annual capital cost for local exchange services and unbundled elements.

20 Q. PLEASE ASSESS THE HATFIELD MODEL'S ASSUMPTIONS ABOUT DEPRECIATION  
21 RATES.

22 A. The Hatfield model uses long depreciation *lives* (i.e., low depreciation *rates*) in estimating the  
23 annual costs of network investments. While such long investment lives may have been  
24 appropriate for a regulated monopoly provider, the competitive environment fostered by the  
25 Telecommunications Act is a different world. The forces of competition themselves, as well as  
26 the technological change that permeates this industry, invalidate the use of the old long

1 depreciation lives. In fact, Professor Hausman demonstrates<sup>26</sup> that accounting for the increased  
2 risk and uncertainty of competition increases the annual cost related to investments by a  
3 multiple of at least 3.

4 HCM 2.2.2 lists asset lives by type of facility, e.g., end office switches have a life of 14.3  
5 years in the model. In order to compare these depreciation lives with external sources, I have  
6 calculated a weighted (by monthly cost) life of about 17 years, which is equivalent to an  
7 annual depreciation rate of 5.9 percent. This rate is somewhat lower than the 1994 book  
8 depreciation of 7.16 percent for RBOCs, let alone the higher true economic depreciation rate.<sup>27</sup>

9 In fact, the FCC has prescribed that economic depreciation lives be used in TELRIC  
10 studies.<sup>28</sup> Of course, economic depreciation rates are much higher. For example, Professor  
11 Schmalensee and Dr. Rohlfs reported that AT&T's depreciation rate is 18.5 percent.<sup>29</sup> Even  
12 AT&T's 1994 book depreciation rate of about 11 percent is much higher than the rates used in  
13 the Hatfield model.

#### 14 **IV. COMPARISON OF COSTS FROM HCM 2.2.2 AND HCM 2.2.1**

15 Q. IN WHAT RESPECTS HAS HCM 2.2.2 (SUBMITTED IN THIS PROCEEDING)  
16 EVOLVED OVER HCM 2.2.1?

17 A. HCM 2.2.2 allows greater control over certain input parameters (particularly input prices) by  
18 the user, although the cost "results" submitted by AT&T are probably based on AT&T-  
19 selected input values, which Mr. Hearst and Mr. Raley demonstrate are unrealistically low.  
20 Also, as stated earlier, HCM 2.2.2 separates structure costs from the cost of cable and  
21 disaggregates expense factors through separate treatment of underground and buried cable

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<sup>26</sup> Affidavit of Jerry A. Hausman, Reply Comments of USTA, in CC Docket 96-98 (filed May 30, 1996), at 6.

<sup>27</sup> Federal Communications Commission, Statistics of Communications Common Carriers, 1995/1995 Edition, Table 2.9.

<sup>28</sup> FCC Order, ¶686.

<sup>29</sup> Richard Schmalensee and Jeffrey H. Rohlfs, *Productivity Gains Resulting From Interstate Price Caps for AT&T*, National Economic Research Associates, September 1992.

1 expenses. In addition, HCM 2.2.2 changes the default assumption of a 12,000 foot loop length  
2 as the cross-over point between copper and fiber cable to 9,000 feet for the feeder portion  
3 alone.

4 AT&T's submission in this proceeding suggests other changes as well. For example, in  
5 applying the HCM 2.2.2 to SWBT-MO, a debt-equity structure of 45 per cent debt and 55 per  
6 cent equity (resulting in a cost of capital of 10 per cent) is used. Depreciation lives are also  
7 somewhat shorter than those originally assumed by HCM 2.2.1. For example, loop plant lives  
8 are reduced to around 19 years (depreciation rates of about 5.3 per cent), and end-office and  
9 tandem switch lives are reduced to 12.7 years (depreciation rates of 7.9 per cent).<sup>30</sup>

10 Q. DO THE MODIFICATIONS EMBODIED IN HCM 2.2.2 SIGNIFICANTLY AFFECT THE  
11 COST RESULTS FROM THE MODEL?

12 A. The cost results change surprisingly little, in light of the substantial changes in some critical  
13 inputs, such as the cost of capital<sup>31</sup> and depreciation.<sup>32</sup> The following Table compares costs  
14 estimated from HCM 2.2.1 and HCM 2.2.2.<sup>33</sup>

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<sup>30</sup> Interestingly, Mr. Flappan's Direct Testimony (Schedule RPF-2, Appendix C)—which is the source of these depreciation assumptions—deviate from the Missouri default depreciation lives contained in the HCM 2.2.2 software made available for public use.

<sup>31</sup> For example, the original 1994 Hatfield model report stated that a 175 basis point difference increases the cost per line by 11%. Thus, moving the model's 8.91% cost of capital in HCM 2.2.1 up to 10% (in HCM 2.2.2) should increase costs by about 7%, i.e., increase the total cost of all elements to \$21.95. Hatfield Associates, "The Cost of Basic Universal Service," Prepared for MCI Communications Corporation, July 1994. These sensitivity tests are primarily illustrative.

<sup>32</sup> The 1994 Hatfield Report indicates that changing depreciation from an average 20 year life (5 percent rate) to 15 years (6.7 percent rate) should increase basic service costs by 13 percent. Applying this relationship to the change in the depreciation rate between HCM 2.2.2 and HCM 2.2.1 (weighted by the cost of network elements, the rate increases from 4.8 percent to 5.9 percent) would increase cost per line by 8.5%, i.e., increase the total cost of all elements to \$22.25.

<sup>33</sup> Source: Hatfield Associates, Inc., *Update of the Hatfield model 2.2, Release 1*, prepared for AT&T Corporation and MCI Telecommunications Corporation (for HCM 2.2.1 results) and AT&T submission in this proceeding (for HCM 2.2.2 results).

<i>Element</i>	<i>HCM 2.2.1 Unit Cost</i>	<i>HCM 2.2.2 Unit Cost<sup>34</sup></i>
Loop Distribution	\$11.46 per month	\$8.37 per month
Loop Feeder	\$0.73 per month	\$2.70 per month
Loop Concentration	\$2.10 per month	\$2.19 per month
Total Loop	\$14.28 per month	\$13.26 per month
End-Office Switching: Port	\$1.22 per line/month	\$1.28 per line/month
End-Office Switching: Usage	\$0.0020 per minute	\$0.0021 per minute
Signaling elements: Links	\$17.95 per link/month	\$26.91 per link/month
Signaling elements: STP	\$0.0003 per message	\$0.00006 per message
Signaling elements: SCP	\$0.0007 per message	\$0.00084 per message
Transport elements: Dedicated	\$12.46 per DS-0 equiv/month	\$4.96 per DS-0 equiv/month
Transport elements: Switched	\$0.0012 per minute	\$0.00049 per minute
Transport elements: Common	\$0.0050 per minute/leg	\$0.00170 per minute/leg
Transport elements: Tandem Switch	\$0.0016 per minute	\$0.0019 per minute
Total: All Elements	\$20.51 per line/month	\$18.69 per line/month

1 This cost comparison is very instructive. First, given that the basic approach of the two  
 2 models and a number of assumptions embodied in them are similar, I believe that both sets of  
 3 results understate the TELRIC for the two categories, "total loops" and "total cost: all  
 4 elements."

5 Second, there is very little change in the TELRICs of those two all-important categories  
 6 despite (what appear to be) substantial modifications in crucial assumptions and inputs such as  
 7 the cost of capital and depreciation rates. In fact, the TELRICs actually decline despite  
 8 adjustments to the cost of capital and depreciation rates that would seem to increase, not  
 9 reduce, costs. However, the all-important fill factors for feeder and distribution loops remain  
 10 pegged in HCM 2.2.2 at the levels selected for HCM 2.2.1. These fill factors are 50-75 per  
 11 cent for distribution loops and 65-80 per cent for feeder loops. These *assumed* fill factors are  
 12 unrealistically high. For SWBT-MO, the actual effective fill factors, on average, are 33.9 per  
 13 cent for distribution loops and 72.63 per cent for feeder loops. HCM 2.2.2 would have to

<sup>34</sup> These unit costs are those reported by AT&T (Mr. Flappan's Direct Testimony, Schedule RPF-3) based on depreciation lives that differ from the Missouri default values in the HCM 2.2.2's software released for public use. Hence, Mr. Flappan's unit cost estimates differ slightly from those that running the publicly-available HCM 2.2.2 would produce.

1 lower its *input* distribution fill to 44.7 per cent, on average, in order to reproduce SWBT-MO's  
2 actual *effective* fill factor of 33.9 per cent.<sup>35</sup> The high—and unchanging—fill factors in the two  
3 models keep the loop cost estimates unrealistically low.

4 Third, while the unit cost of feeder loops increases in HCM 2.2.2 by \$1.97 per month, that  
5 increase is more than offset by a \$3.09 per month decline in the unit cost of distribution loops.  
6 With a very minor change in the monthly unit cost of loop concentration, that leaves the  
7 monthly unit cost of *total* loops more than a dollar lower than before. Whatever impact  
8 changing the financial assumptions (depreciation, cost of capital) may have had appears to  
9 have had a minimal influence on the unit cost of loops. This is surprising in light of what is  
10 known about how much cost changes in the BCM loop investments module when either the  
11 depreciation rate or the cost of capital changes.<sup>36</sup>

12 Fourth, I observe significant *reductions* in HCM 2.2.2 in the unit costs associated with  
13 transport elements despite modest unit cost increases for switching and signaling elements.  
14 These could be attributed to the changes in model assumptions made by HCM 2.2.2 for these  
15 elements. The *magnitude* of those changes, however, is quite remarkable. The \$1.02 decline  
16 in the monthly unit cost of total loops in HCM 2.2.2 is accompanied by a \$0.80 decline in the  
17 costs of the central office and inter-office facilities, thus bringing the total monthly unit cost of  
18 all elements *down* by \$1.82.

19 Q. DID YOU RUN HCM 2.2.2 WITH INPUT VALUES PROVIDED BY SWBT-MO FOR  
20 SPECIFIC MODEL PARAMETERS?

21 A. No, I have not yet had the opportunity to do so. I have, however, made such a run with input  
22 values provided by the Southwestern Bell Telephone Company for its operations in Texas.  
23 The input values provided for Texas modified the HCM 2.2.2 default values for a number of  
24 parameters including the weighted average cost of capital, depreciation lives (for loop plant,  
25 switching, etc.), fill factors for distribution and feeder loop plant, switching costs per line by

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<sup>35</sup> These results were obtained from the data and calculations referred to in note 23, *supra*.

<sup>36</sup> See notes 31 and 32, *supra*.

1 switch size, cost of manholes, support structure sharing fractions, costs of specific signaling  
2 elements, etc. I found that these modifications led to significant changes in the estimates of  
3 unit costs for unbundled loops and all unbundled elements. For example, the unit cost for  
4 loops rose 55 per cent, from \$11.62 per month (under default parameter values) to \$17.97 per  
5 month (under corrected parameter values). There was a corresponding increase, by 70 per  
6 cent, in the cost of all unbundled elements from \$16.51 per line/month to \$28.07 per  
7 line/month. A similar exercise can easily be conducted for SWBT-MO once corrected  
8 parameter values are available.

9 Q. PLEASE SUMMARIZE WHAT OTHER FACTORS IN HCM 2.2.2 MAY CAUSE IT TO  
10 CONTINUE UNDERSTATING THE COSTS OF NETWORK ELEMENTS?

11 A. HCM 2.2.2 does not employ an adequate adjustment to account for topographical  
12 characteristics (such as bodies of water or hills) or institutional barriers (such as rights-of-  
13 way). Simply scaling airline distances up (or, using rectangular distances) to account for  
14 possible topographical or institutional barriers does not suffice to capture the true additional  
15 costs imposed by these or to correctly assign the CBGs to SWBT-MO wire centers. Further,  
16 although the depreciation rates and cost of capital calculation are less unrealistic in HCM 2.2.2  
17 as compared to HCM 2.2.1, as explained above, they remain quite some distance away from  
18 the financial parameters that should really apply in a competitive market.

19 **V. ASSESSING THE HATFIELD MODEL'S POLICY APPLICABILITY**

20 Q. GIVEN THAT HCM 2.2.2 APPEARS TO HAVE MADE MODIFICATIONS TO AND  
21 IMPROVEMENTS OVER HCM 2.2.1, ARE THERE STILL ISSUES THAT REMAIN TO  
22 LIMIT THE USEFULNESS AND APPLICABILITY OF THE HATFIELD MODEL?

23 A. Yes. While HCM 2.2.2 appears to be a modest improvement over HCM 2.2.1, there are still  
24 problems with modeling *philosophy* that I believe severely restrict its usefulness. First, all  
25 incarnations of the Hatfield model are based on the principle that the "costs that incumbents  
26 actually expect to incur" do not matter. Second, some of the policy implications for any  
27 deviation (by SWBT-MO or any LEC) from the hypothetical "optimal" model results are very

1       troubling. Third, the Hatfield model remains very schizophrenic about the role of monopoly  
2       and competition in conditioning the costs of an actual network.

3       Q. PLEASE EXPLAIN WHY A NETWORK'S ACTUAL CIRCUMSTANCES SEEM NOT TO  
4       MATTER IN THE HATFIELD MODEL, IRRESPECTIVE OF VERSION.

5       A. The sponsors of the Hatfield model have openly acknowledged the model's orientation toward  
6       a *hypothetical* network.

7       The Hatfield Model develops estimates of the economic costs (TELRIC) of  
8       providing local telephone services by determining the specifications of a local  
9       network, using most efficient practices and best forward-looking technologies, to  
10      meet the total demand for local narrowband telephone services. By doing this, *the*  
11      *model simulates the construction and operations decision-making of an efficient*  
12      *local service provider that must create and operate a new network to meet current*  
13      *and reasonably forecasted demand levels* for narrowband telephone services. In  
14      simulating the construction of these *hypothetical* networks, the model incorporates  
15      realistic assumptions concerning the LECs' ability to adopt and implement  
16      efficient, cost minimizing production techniques.<sup>37</sup>

17      Q. WHAT ARE THE POLICY IMPLICATIONS OF PRICING NETWORK ELEMENTS  
18      BASED ON COST ESTIMATES SUCH AS THOSE PRODUCED BY ANY VERSION OF  
19      THE HATFIELD COST MODEL ?

20      A. Costs estimated for the so-called *average* or hypothetical network (that presently does not  
21      exist) are *not* sufficient to inform public policy deliberations about the pricing of an *actual*  
22      network's unbundled services or the *actual* costs of its universal service program. My fear is  
23      that if the hypothetical costs *were* regarded as suitable inputs for policy decisions, *any*  
24      departure of an incumbent LEC's costs from those hypothetical costs could be read as *prima*  
25      *facie* evidence of inefficiencies in the LEC's operations. No conclusion could be more  
26      unrealistic or unfair. Yet, there have been attempts in the past to discredit LEC estimates of  
27      the size of the universal service program by declaring the spread between the lower estimate of

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<sup>37</sup> *Hatfield model, Version 2.2, Release 1, at 2. (Emphasis added)*

1 that size (produced by hypothetical costs) and the higher estimate (produced by actual costs) as  
2 simply an estimate of LEC waste and inefficiency.

3 I believe a model such as the Hatfield must be judged by two criteria:

- 4 1. How well can its assumptions and cost estimates represent or reproduce those of an *actual*  
5 network?
- 6 2. How easily can it accommodate a network's historical circumstances, future technology  
7 and operational choices, and actual input prices, given the increasing uncertainty about  
8 demand engendered by greater market competition and reduced regulation?

9 A second troubling implication is that the "scorched node" approach used in the Hatfield  
10 model pretends that the costs produced by the model must have *universal* validity — for the  
11 entrant, for the incumbent LEC, and, indeed, for any LEC (regardless of its prior history) that  
12 can continually re-optimize its network. A *single* cost figure is expected to apply, going  
13 forward, to any and all LECs regardless of their individual circumstances. If, indeed, the  
14 incumbent LEC and the entrant — both operating as efficiently as possible — differ in their  
15 network design, technology, and strategy choices, how can a *single* cost estimate (produced by  
16 the Hatfield model) serve as a basis for comparing those choices? Further, would it make  
17 sense to judge the relative efficiencies of the different competitors by a cost estimate that only  
18 pertains to a hypothetical network? The answer to both questions is an emphatic "No." The  
19 hypothetical network that the model adopts corresponds to the network of a mythical new  
20 entrant that completely displaces the incumbent LEC. Thus, *no* facilities-based local exchange  
21 provider will enjoy costs as low as those produced by HCM 2.2.2. This remains *the*  
22 fundamental problem with all versions of the Hatfield model, including HCM 2.2.2.

23 Q. HOW DOES THE HATFIELD COST MODEL FAIL TO CONSIDER THE IMPACT THAT  
24 COMPETITION WILL HAVE ON COSTS?

25 A. The Model's continued use of the incumbent LEC's *total* demand to calculate the incremental  
26 costs clearly builds in the effect of economies of scale that are only possible under monopoly  
27 supply. Those assumed economies of scale would tend to generate unrealistically low cost  
28 estimates for a competitive market with multiple service providers. In such a market, the

1 multiple providers will each serve demand segments that are smaller than the entire market.  
 2 As a result, the scale economies possible under monopoly supply will simply not be available.  
 3 Therefore, the TELRICs that would be experienced by multiple competitors that share the total  
 4 market demand would be *larger* than the TELRIC of a monopoly serving the entire demand.  
 5 This is a fundamental problem with the Hatfield model's TELRIC approach which assumes  
 6 that the increment of demand to use in the model is the total demand faced by SWBT-MO,  
 7 currently the sole provider of switched network elements in its serving area.

8 Further, the lower cost of capital and somewhat longer depreciation lives and different  
 9 capital structures also contribute to lowering the costs reflected in the Hatfield model.

10 Q. PLEASE SUMMARIZE YOUR ASSESSMENT OF THE HATFIELD MODEL.

11 A. Numerous sources of bias are built into the Hatfield model assumption and input structure.  
 12 Despite claims that the Hatfield model is likely to produce "conservatively high" cost  
 13 estimates, there is serious built-in potential for underestimation of the actual costs of a network  
 14 like SWBT-MO's.

15 The fundamental problem with basing unbundled network element prices on cost estimates  
 16 that are too low is that facilities-based local exchange competition may be stopped in its tracks  
 17 as a result. New entrants will be inhibited by artificially low prices and the incumbent LECs  
 18 will not have proper incentives to improve their networks. The likely end-state is monopoly  
 19 supply of network elements, not as a result of underlying cost and demand characteristics, but  
 20 as a deleterious result of improper prices imposed by regulators on the basis of a flawed model  
 21 like HCM 2.2.2.

22 Q. DOES THIS CONCLUDE YOUR TESTIMONY?

23 A. Yes.



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**COMMENTS OF  
WILLIAM E. TAYLOR AND ANIRUDDHA BANERJEE**

**Before the Federal Communications Commission**

**CC Docket No. 96-45**

**August 9, 1996**

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**COMMENTS OF  
WILLIAM E. TAYLOR, PH.D., AND ANIRUDDHA BANERJEE, PH.D.**

**I. INTRODUCTION AND SUMMARY.**

We are William E. Taylor, Senior Vice President of National Economic Research Associates, Inc. (NERA), head of its telecommunications economics practice and head of its Cambridge office, and Aniruddha Banerjee, Senior Consultant at NERA. Our business address is One Main Street, Cambridge, Massachusetts 02142.

Dr. Taylor has been an economist for over twenty years. He received a B.A. degree in economics (Magna Cum Laude) from Harvard College in 1968, a master's degree in statistics from the University of California at Berkeley in 1970, and a Ph.D. in Economics from Berkeley in 1974, specializing in industrial organization and econometrics. He has taught and published research in the areas of microeconomics, theoretical and applied econometrics, and telecommunications policy at academic institutions (including the economics departments of Cornell University, the Catholic University of Louvain in Belgium, and the Massachusetts Institute of Technology) and at research organizations in the telecommunications industry (including Bell Laboratories and Bell Communications Research, Inc.). Dr. Taylor has participated in telecommunications regulatory proceedings before state public service commissions and the Federal Communications Commission ("FCC" or the "Commission") concerning competition, incentive regulation, price cap regulation, productivity, access charges, pricing for economic efficiency, and cost allocation methods for joint supply of video, voice and data services on broadband networks.

Dr. Banerjee received B.A. (with Honors) and M.A. degrees in Economics from Delhi University, New Delhi, India, and a Ph.D. in Agricultural Economics from the Pennsylvania State University in 1985. He has taught undergraduate and graduate Economics courses in microeconomics, industrial organization, public finance, and statistics and econometrics. He has published papers on futures markets and has made several presentations on demand and

cost analysis, and regulatory and competition policy in telecommunications. Prior to his present appointment at NERA, Dr. Banerjee has held positions with AT&T, Bell Communications Research, and BellSouth Telecommunications. He has participated in or contributed to several state and federal regulatory proceedings in the U.S. and Canada.

We have prepared our comments at the request of BellSouth Telecommunications, Inc., to appraise the Hatfield 2.2, Release 1, economic cost model ("Hatfield model" or "model") submitted by MCI Communications Corporation and AT&T Corporation on July 5, 1996, in CC Docket 96-45. This follows publication of the FCC's Public Notice on July 10, 1996, seeking comments on the Hatfield model and the Benchmark Cost Model 2.

Our primary conclusion from an appraisal of the Hatfield model is that it is fundamentally flawed and ill-suited to the task of determining a carrier's cost of supplying basic residential service. Because of this, we recommend that the model — as presently constructed — not be used for the purpose of determining the true costs of the universal service program or the size of the support fund being contemplated under universal service reform. At present, there are just too many questionable assumptions embedded in, or results derived from, the model to render it of any value for that task.<sup>1</sup>

## II. BACKGROUND

As the Commission has turned its attention to universal service reform — an important component of changes contemplated by Section 254 of the Telecommunications Act of 1996 — it has sought specifically to address the task of sizing the amount of support needed to administer the universal service program under local exchange competition. Comments and Reply Comments in CC Docket 96-45 brought forward submissions from various parties of engineering models intended to measure the economic cost of providing basic residential

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<sup>1</sup> Essentially the same conclusions have been reached by Timothy J. Tardiff in *Economic Evaluation of Version 2.2 of the Hatfield Model*, prepared for GTE, July 9, 1996.